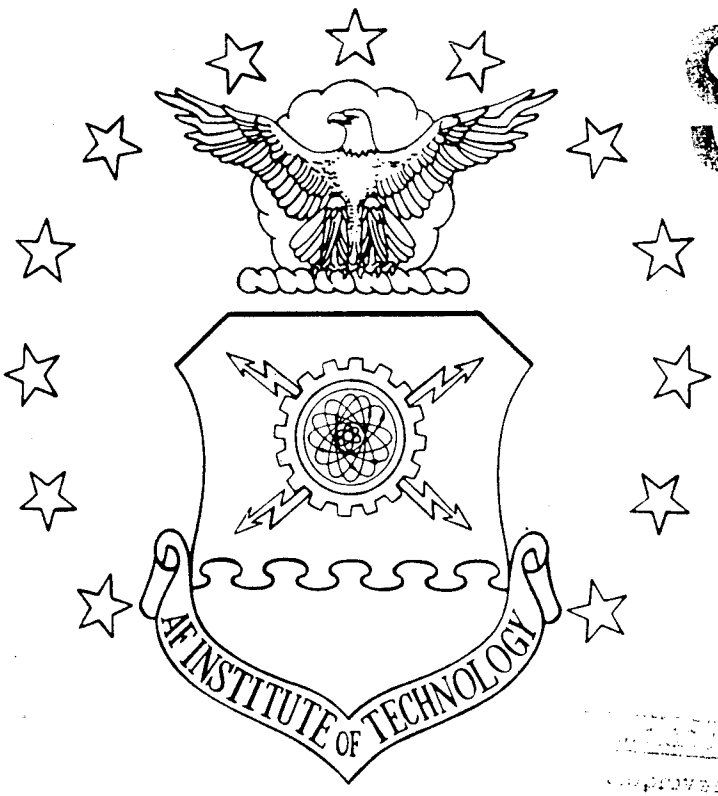

EVALUATION OF AN AIR FORCE INFORMATION RESOURCES MANAGEMENT (IRM) OVERVIEW COURSE

THESIS

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The views expressed in this thesis are those of the authors and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

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EVALUATION OF AN AIR FORCE INFORMATION RESOURCES MANAGEMENT (IRM) OVERVIEW COURSE

THESIS

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Air Education and Training Command

In Partial Fulfillment of the

Requirements for the Degree of

Master of Science in Logistics Management

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Preface

The purpose of this thesis is to evaluate an Air Force information resources management (IRM) overview course. This study included a quantitative and qualitative assessment of the effectiveness of the course. Likewise, the research provided a general, qualitative evaluation of the course as a whole, functioning instructional system.

Many people contributed mightily to the successful completion of this research effort. We wish to thank the participants in the pilot administration of the course. Their inputs set the stage for numerous improvements to the course. With regards to the pilot administration of the course, we would also like to thank Major Phil McDowell and Captain Dave Morgan for their extensive help in coordinating the whole effort. Likewise, we would like to thank those individuals who participated in our reliability testing. Of course, we would like to thank our research advisors, Dr. Guy Shane and Dr. Kim Campbell, for their patience and guidance throughout the thesis process.

Captain Forcht would like to thank her husband, Mike, and sons, Geoffrey and Gregory, for their unfailing and enthusiastic support throughout the exhaustive thesis effort. Lieutenant Cox wishes to thank his son, Brelan, for understanding and accepting his father's absence during this academic pursuit.

Joseph L. Cox

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Abstract

The federal government has passed laws and issued directives recognizing that information is a valuable national resource. To help assure that Air Force information managers are capable of implementing policy in support of such laws and directives, the Secretary of the Air Force's Directorate of Information Management (SAF/AAI) directed a team from the Air Force Institute of Technology (AFIT) to design and construct an exportable course to provide an overview of information resources management (IRM) concepts and principles. Such an IRM overview course was completed in the Summer of 1994. The authors evaluated this course quantitatively and qualitatively. During a pilot administration of the course, the authors used a quantitative measurement instrument and a pre-test/posttest research design to assess effectiveness of the instructional system. The authors also gathered feedback from students and instructors to provide a summative evaluation of the course as a whole. Based on test scores and qualitative feedback, the authors concluded that the course did provide a useful overview of IRM concepts and principles. Additionally, they were able to recommend several changes to the course presentation, content, and measurement instrument.

EVALUATION OF AN AIR FORCE INFORMATION RESOURCES MANAGEMENT (IRM) OVERVIEW COURSE

I. Introduction

Background

By the mid 1980s, managers realized that automation alone was not the answer to increased productivity. Management began to view information as a resource that needs to be managed for increased productivity, and automation as a tool to provide managers access to the information that they need to make decisions. Furthermore, businesses recognized that solutions to organizational productivity problems lay not in how much information can be automated, but rather, in what information was necessary to support vital business processes. A business process is "a group of logically related tasks (decisions and activities) that, when performed, utilize the resources of the business to produce definitive results" (Kane, 1986:26).

As a result of the newfound importance of information, various methodologies were developed to effectively manage organizational information. These methodologies eventually evolved into a unique management sub-discipline known as information resources management (IRM).

The Importance of IRM. IRM is, in its most general sense, the management of information as a corporate resource (Newcomer and Caudle, 1986:29-31). Organizations have always been concerned with managing corporate resources in a productive manner. Historically, the most important corporate resources have been personnel, capital, and

finances. However, over the past two decades, information has come to hold equal, if not superior, status to these crucial resources (Zwass, 1992:15).

As the importance of information and data, which are the component parts of information, became more obvious, organizational strategies for the management of information developed. Most information management strategies revolve around the ability to organize mission-critical data into corporate databases (Zwass 1992:16). IRM strategies provide a means to integrate the technical specifications for data storage and retrieval with management and customer needs for data access. Such technical specifications become the basis for information systems, whereas management and customer needs are defined by organizational transactions and processes. Thus, IRM is a mechanism through which technical capabilities (information technology) and organizational processes are matched with user needs to benefit the organization (Newcomer and Caudle, 1986:29-31; Zwass, 1992:16).

Federal Government and IRM. Although typically associated with private sector initiatives, IRM principles also apply to government organizations (Corbin, 1993:26). In fact, the federal government should be especially careful to effectively manage its information resources. Because it is the basis for virtually every transaction conducted by the government, "information is to government what manufactured goods are to private industry" (Johnson, 1992:6). Indeed, "the federal government is the nation's largest single producer, consumer, and disseminator of information" (GSA, 1993:1-1). Therefore, it is no surprise that in light of recent government initiatives to cut spending and streamline business processes, adoption of IRM concepts has become one of the prime mandates of the federal legislature and the executive branch. The importance of IRM has led the government to establish commissions, launch programs, pass laws, and perform studies to examine federal IRM activities (GSA, 1993:1-1).

Legislative Initiatives. Although an abundance of federal IRM legislation exists, the Paperwork Reduction Act of 1980, the Office of Management and Budget (OMB) Circular A-130, and the Federal Information Resource Management Regulations (FIRMR) are some of the most important legislative documents addressing federal implementation of IRM principles (Johnson, 1992:8-9). Together, these legislative directives outline organizational IRM responsibilities, policies, and procedures for federal government agencies. As such, these legislative documents require federal agencies to manage information in an efficient, effective, and economical manner, essentially making IRM an agency-wide function. Today, federal managers "must address all of the planning, budgeting, organizing, directing, training, and controlling functions associated with information" (Johnson, 1992:6).

Executive Initiatives. In addition to the legislative backing for IRM, President Clinton and Vice President Gore have recently introduced two initiatives that spotlight the executive branch's commitment to IRM principles. First, the executive branch initiated a National Performance Review (NPR) to identify inefficient business processes in need of process reengineering (Corbin, 1993:26). Process reengineering is a technique pioneered by business consultant Michael Hammer which uses the "power of modern information technology to radically redesign...business processes in order to achieve dramatic improvements" in organizational effectiveness (Hammer, 1990:104). Through this reengineering effort, the President hopes to "challenge the basic assumptions of every program, asking does it work; does it provide quality service; does it encourage innovation and reward hard work" (Grassley, 1993:168). Further, a main goal of the NPR is to allow the executive branch to begin "getting rid of 12 percent of the government's civilian employees-252,000 jobs-by cutting layers of management" (Shoop, 1994:10).

Additionally, through reengineering efforts, the Department of Defense hopes to reduce its administrative spending by as much as $70 billion (Green, 1994:S4).

Second, the White House introduced the National Information Infrastructure (NII) Agenda for Action which outlines plans for the development of a nationwide network of networks to insure universal access to federal information resources (The White House, 1993a). The NII Agenda for Action "dramatically sketched a vision of the near future, in which a web of advanced communications networks and computers would bring vast amounts of information and greatly improved services to...virtually every citizen" (IITF, 1994).

Focus on People. Clearly, IRM is an important issue for the public and private sectors. However, until recently, the federal sector had been much slower than industry to adopt IRM principles. Consequently, the government recently committed to making IRM strategic planning one of its top priorities. Moreover, because IRM initiatives must be supported and carried out by highly skilled personnel, the federal government has made the acquisition, education, and training of IRM professionals one of the tenets of its overall strategic planning model (GSA, 1993:2-3).

Department of the Air Force and IRM. In compliance with federal IRM directives, the Department of the Air Force has recently focused on the role of IRM in the performance of its mission. The Air Force considers effective management of information resources the "key to battlefield interoperability and aerospace domination" (SAF, 1993:1). In fact, the Air Force has recently committed to incorporating IRM doctrine into the overall doctrine of the Air Force, AFMAN 1-1, Basic Aerospace Doctrine of the

United States Air Force. The new version of the Air Force doctrine document will, for the first time, incorporate information life-cycle management concepts, a main tenet of IRM. Further, current research at the Air Force Institute of Technology (AFIT) is expected to produce a list of IRM tenets to be the basis for inclusions to future versions of Air Force doctrine (Bowser, 1994).

Acknowledging the key role that IRM professionals must play in support of the mission, the Air Force has developed five strategic goals related to the management of information, as well as accompanying objectives and task plans outlining how these goals are to be accomplished. The five goals follow:

> Goal 1: Enhance readiness to support the USAF war and contingency mission
>
> Goal 2: Improve information management support to commanders
>
> Goal 3: Develop information managers for changing environments
>
> Goal 4: Improve the methods for managing information throughout its lifecycle
>
> Goal 5: Improve information management (IM) resource management.
> (SAF, 1993:8-9)

Although each of these goals is vitally important to the overall mission of the Air Force information management community, the development of information managers for changing environments is a prime focus given recent federal government initiatives. Presently, Air Force information managers perform duties which have not historically embraced the principles of IRM. In fact, Air Force information managers often do not

have the skills necessary to properly manage information resources (SAF, 1993:51). Information managers without IRM skills cannot carry out their primary mission--"to assist functional customers in identifying their information needs" (SAF, 1993:55). Consequently, the Air Force Directorate of Information Management (SAF/AAI) has identified a specific need to expand educational and training opportunities for information managers. Air Force leadership intends that information managers will hasten the integration of IRM principles at every organizational level (SAF, 1993:55).

In one effort to satisfy this training requirement, SAF/AAI tasked a team from AFIT to design and construct an exportable IRM course tailored to familiarize mid-level Air Force information managers with IRM concepts and principles. It should be noted that the researchers for this study were a part of the team that developed the course. The first version of this course was recently completed. The seven-module course was designed to provide an overview of IRM concepts and principles. Table 1 describes the IRM subject matter contained in each module of the course.

Table 1

IRM Course Content

Module	Content
1	Introductory IRM concepts and terms
2	Key federal IRM laws and organizations
3	Corporate Information Management goals and policies
4	Strategic planning process and IRM applications
5	Business process improvement methodology
6	Systems development life-cycle concepts
7	Information engineering methodology

General Issue

Before fielding the IRM course developed by the AFIT project team, SAF/AAI directed the course be evaluated in accordance with AFMAN 1-1. AFMAN 1-1 states that "people are the decisive factor in war," and training and education are necessary to effectively prepare people to perform their mission. Likewise, this doctrine dictates that all training and education should be vigorously evaluated (DAF, 1992:18). AFMAN 36-2234, Instructional System Development (ISD) provides a mechanism for satisfying this evaluation requirement.

ISD Functions. The ISD process exists within the larger framework of the five main functions of a total instructional system. From the most general level, a total instructional system is composed of the following interrelated functions: management, support, administration, delivery, and evaluation. Figure 1 shows how these functions mesh together and emphasizes the central role which evaluation plays in the development of instruction. The scope of each of the functions is described below.

- Management - the function of directing or controlling instructional systems development and operations
- Support - the function of maintaining all parts of the system
- Administration - the function of day-to-day processing and record keeping
- Delivery - the function of bringing instruction to students
- Evaluation - the function of gathering feedback data through formative, summative, and operational evaluations to assess system and student performance. (DAF, 1993b:12-13)

The ISD process is composed of four phases: analysis, design, development, and implementation (DAF, 1993b:14). These phases are described in detail and the complete ISD model is presented in the discussion of methodology in Chapter II of this paper. From the description of ISD provided to this point, it is important to realize that "evaluation is a central function that takes place at every phase" of ISD (DAF, 1993b:14). Consequently, rigorous evaluation is the cornerstone of effective instructional system.

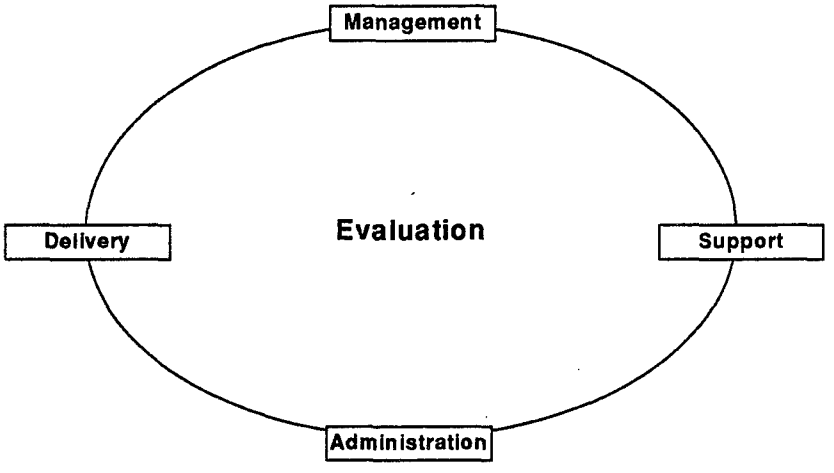

Figure 1. *ISD Systems Functions* (DAF, 1993b:12)

ISD and Evaluation. Evaluation is the act of providing "feedback leading to a successful outcome defined in practical , concrete terms" (Isaac and Michael, 1985:2). The purpose of instructional evaluation is to improve instructional systems by measuring performance against established standards (Bloom, 1971:7). Without evaluation, one has no method of assessing the value of an instructional system. Three types of evaluation are germane to ISD: formative evaluation, summative evaluation, and operational evaluation (DAF, 1993a:7).

Formative Evaluation. Formative evaluation is the process of keeping an instructional system true to its design. Such evaluation is focused on providing feedback

for making mid-course corrections to the system (Isaac and Michael, 1985:5; Foley, 1971:804-805). Formative evaluation includes the process and product evaluations conducted during the analysis and design phases of ISD and validation through small group tryouts during the development phase of ISD (DAF, 1993a:7).

Summative Evaluation. Summative evaluation provides a "general assessment of the degree to which...larger outcomes have been obtained over the entire course of instruction" (Bloom, 1971:61). This type of evaluation might include operational tryouts of an instructional system. Summative evaluation is typically conducted as the last step of the validation process during the development phase of ISD (DAF, 1993a:7).

Operational Evaluation. Operational evaluation is basically on-going evaluation of an instructional system, after it has been adopted in the field. The purpose of such evaluation is to enhance an instructional system during full-scale operations (DAF, 1993b:187). As such, operational evaluation includes periodic internal and external evaluation of an operational instructional system (DAF, 1993a:7).

Specific Purpose

SAF/AAI identified a need for delivery of IRM education and training to all Air Force information managers. In an effort to satisfy one part of this requirement, a team from AFIT developed an exportable IRM course for mid-level Air Force information managers. Our purpose in this research was to evaluate this course.

Research Objective

The primary objective of our research was to evaluate the course as an instructional system. In support of this objective, we needed to met two sub-objectives. First, we had to determine the basis for evaluating the course. Second, we needed to develop measurement tools to gather the data to be used in making an evaluation.

Thesis Overview

Chapter II describes the methodology used in this research. It presents and explains our research design and measurement instruments. Chapter III describes and analyzes data obtained from our evaluation of the IRM course. As such, Chapter III provides quantitative and qualitative data regarding the effectiveness of the course. Finally, Chapter IV contains conclusions, recommendations, and suggestions for further research.

II. Methodology

Introduction of Methods

In order to meet our research objective and sub-objectives, we employed a combination of methodologies. We conducted our research within the framework of the ISD model. After outlining the methodology associated with the ISD model and our subject course's development in relation to the model, we will present our research design, discussing the development of our measurement instrument and the administration of our experimental treatment.

ISD Model

The ISD model is designed to aid in the development of effective, cost-efficient instruction. The overall model has three major parts: systems functions (described in Chapter I), ISD phases, and quality improvement (DAF, 1993a:3). Figure 2 provides a view of the entire ISD model. It depicts the systems functions and ISD phases embedded within the quality improvement process. The following sections briefly discuss the ISD phases, the quality improvement aspects of the ISD model, and how the course fits into the model.

ISD Phases. The ISD process is composed of four distinct phases: analysis, design, development, and implementation. The following sections describe each of these phases.

Analysis Phase. In this phase, the instructional designer analyzes the requirements which the instruction is seeking to fulfill. The designer seeks to link performance requirements to knowledge, skills, and abilities that can be presented through instruction (DAF, 1993a:6).

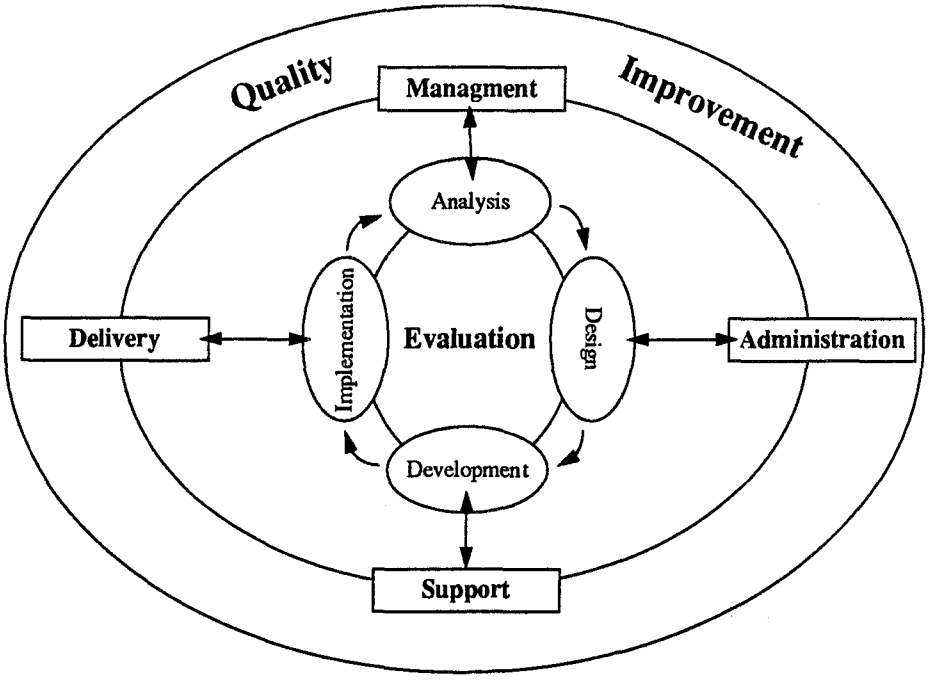

Figure 2. *The Air Force ISD Model* (DAF, 1993b:15)

Design Phase. In this phase, "the instructional designer develops a detailed plan of instruction" (DAF, 1993a:6). This plan includes instructional methods, media, and strategies. Existing instructional materials are reviewed to determine their applicability for the instruction under development. Ideally, this phase also includes the development of objectives and tests (DAF, 1993a:6).

Development Phase. In this phase, the instructional designer develops student and instructor material. Additionally, the designer validates each module of instruction and its supporting material. This validation should include: internal review (formative evaluation); small group tryouts (formative evaluation); and field tryouts of the system (summative evaluation). Revisions are then made to the course based on this validation process, and the instructional materials are finalized (DAF, 1993a:6).

Implementation Phase. In this phase, the instructional system is ready to be implemented. As such, it is fielded under normal operating conditions. To assure the continuing quality of the instruction and material, internal and external evaluations are conducted to provide feedback for improvements to the system (DAF, 1993a:6).

ISD Model and Quality Improvement. "Quality improvement is the continuous, organized creation of beneficial change to the instructional system" (DAF, 1993a:8). Quality improvement is intended to foster continuous improvement in the instructional process and the product of that process. In general, the ISD process is reliant on many quality improvement tenets, including: "the customer defines quality", "know your mission", "know your customer", "set standards", and "evaluate quality constantly" (DAF, 1993a:8-9). As such, the principles of quality improvement are implemented in the ISD process.

ISD and the IRM Course. Although the course we evaluated had completed the analysis phase of ISD, it had not completed the design or development phases. Specifically, the student and instructor lesson materials had been developed, the presentation media selected, and slides produced. An internal review of the course materials for accuracy (formative evaluation) had been completed by the course

developers and local content experts. In addition, the course designers had completed a small-group tryout (formative evaluation) by presenting several modules of instruction from the course to a group of graduate IRM students from AFIT. However, the designers had not developed a test for the instructional system, nor had they completed a field tryout of the whole system (summative evaluation). The evaluative focus of our research therefore was to develop a test for the instructional system and to conduct summative evaluation.

Research Design

The main thrust of our research was to evaluate the IRM course. We chose a one-group pretest-posttest research design as the primary mechanism for determining the effectiveness of the course and to provide a forum for other summative evaluation. This pre-experimental design allowed for a simple, direct comparison of student scores before and after the administration of the experimental treatment, the IRM course instruction (Campbell and Stanley, 1963:7).

We analyzed the difference in mean scores within each module between administrations via a paired difference test. To perform this test, we used the paired *t*-test function within *Statistix*, a statistical software program (Statistix, 1992). In performing this test, we looked for evidence that the mean scores within each module from the first administration of the measurement instrument would be significantly lower than the mean scores within each module from the second administration of the measurement instrument (McClave and Benson, 1991:424).

In order to perform this test, we made two assumptions about the population of differences. First, we assumed that the relative frequency distribution of the population of

differences is normal. Second, we assumed that these differences are randomly selected from the population of differences (McClave and Benson, 1991:424).

Measurement Instruments

We developed three instruments with which to evaluate the effectiveness of the course. First, we devised two qualitative instruments to capture instructor and student perceptions of the course. Second, we developed a quantitative instrument to measure the effect of the treatment (IRM course) on the students. The following sections present these instruments and discuss their development.

Qualitative Instruments. We provided instructors and students with the opportunity to assess the various factors impacting the effectiveness of the IRM course. The student feedback form is found in Appendix A, and the instructor feedback form is found in Appendix B. Both groups, instructors and students, were asked to comment on the relevance of course content, the usefulness of course materials, and the extent to which the course met its overall objective (which was to familiarize students with IRM concepts and principles). Additionally, the students were asked to comment on the quality of instructional delivery.

Quantitative Instrument. In order to gather the data need to summatively evaluate the IRM course, we needed an instrument to quantitatively measure student attainment of the behavior specified by the course objective (DAF, 1993b:77). In this case, we needed to measure the level of familiarity with the material presented in the IRM course. Using such an instrument within the structure of our research design, we hoped to gain a measure of the effectiveness of the course. To this end, we developed an objective

measurement instrument to evaluate the IRM course. Specifically, we determined that a multiple-choice format test instrument was the most appropriate for our purpose.

Characteristics of Multiple-Choice Tests. A multiple-choice test was inherently well suited for our purpose. Aiken described the following characteristics of multiple-choice tests which were particularly important for our study:

- Versatility, multiple-choice tests can measure both simple and complex objectives at almost all grade levels and in all subject areas
- More adequate sampling, multiple-choice tests can sample the domain of abilities more satisfactorily than essay items and almost all other objective items
- Less susceptiblity than true-false items to both guessing and response sets
- Objectivity of scoring, multiple-choice tests can be scored accurately and rapidly by a clerk (the grader need not have special knowledge of the subject matter)
- The provision of diagnostic information by an analysis of responses to item distracters
- Greater reliability than other test items, multiple-choice tests are both objective and less susceptible to guessing effects. (Aiken, 1987:44)

Pool of Questions. We then developed a pool of test questions that were likely to accurately measure the participants' achievement of course objectives. Some questions were pulled from established test banks. However, when established test banks with appropriate material were not available, we used the course objectives to develop questions directly from the course material. We originally prepared 185 multiple-choice items which covered the entire range of course content.

Wood suggests basing test items on fundamental concepts, purposes, causal relationships, and extensions of applications to new problems, rather than on facts acquired by rote memory or inconsequential details (Wood, 1960:44-50). We made a great effort to accomplish these goals in developing the test items. Additionally, we followed many of Wood's suggestions in constructing test items. Most items were written as direct questions, although a few were incomplete statements which required the test taker to complete a thought. We tried to be economical in our use of language, so as to reduce reading time and complexity for test takers. Most items were presented in a positive form with emphasis on any negative aspects of the items to avoid confusion on the part of the test takers (Wood, 1960:44-50).

We followed Wood's advice when devising the alternatives for each item as well. We tried to ensure the alternatives were plausible and followed grammatically from the statement of the problem. We made alternatives parallel in grammatical form and length to avoid giving clues to the correct response. *None of the above*, *All of the above*, and alternatives indicating more than one correct alternative were used in some test items. However, whenever possible, we provided one correct response choice and a full set of plausible, but incorrect, alternatives to serve as distracters. Alternatives were randomly placed using a random number table except in situations where the alternatives logically belonged in a set order (Wood, 1960:50-60).

Validity. Validity customarily refers to the extent to which an instrument measures that which its user intends to measure (Lindquist, 1942:213). According to this concept, validity is determined by comparing what the instrument measures against what it ought to measure. For the purpose of our research content validity and format bias (which could affect validity), were of special concern. Content validity refers to the extent to which a test includes a representative sample of the universe of content and objectives for

the course or subject field which is being measured (Green, 1970:64). Format bias, as used here, refers to the extent to which the test items were formatted in a manner that might be ambiguous to test takers.

To assure we achieved content and avoided format bias within our test, the individual test items from our pool of questions were evaluated by local subject matter experts. Specifically, each test item was reviewed by at least two content and format experts.

Qualification of Subject Matter Experts. A subject matter expert is "a person who has high-level knowledge and skill" in a particular subject area (DAF, 1993b:188). The item reviewers met this definitional standard as subject matter experts. Specifically, the two psychometrics (format) evaluators hold doctoral degrees and have extensive practical experience in the field of psychometrics. Of the five IRM evaluators, four hold doctoral degrees in IRM or a related field. The other IRM subject matter expert holds a masters degree in IRM and is a practicing information resources manager.

Content Validity. With respect to content validity, because the course is composed of seven modules which focus on different disciplines within the field of IRM, different combinations of evaluators were used for each module. Each content expert was asked to self-determine which sections he felt most confident in evaluating. Based on the responses from the evaluators, we assigned each content expert only those items which were designed to test familiarity with material from the module(s) in which he felt most knowledgeable. The test items were evaluated as to whether they actually measured the concepts outlined within the objectives for a particular module and adequately represented the content of the subject area from which the module's material was drawn. In cases where the experts had a difference of opinion, each evaluator was

informed of the opinions of the remaining experts and a consensus was reached. Concerning content validity, we selected only those test items found to be valid by the content experts.

Format Bias. Format bias was assessed by having two psychometrics experts review the structure of each test item that survived content validation. As with our content validation process, when these two experts disagreed as to the existence of bias in the format of an item, each was informed of the other's opinion, and a consensus was reached. Only those items which passed this formating process were included in our initial 160-question measurement instrument.

Selecting Items for the Measurement Instrument. To ascertain which items would be included in the final measurement instrument, a test containing all 160 test items remaining in the pool was administered to 28 AFIT graduate students with knowledge and skills that closely resemble the knowledge and skills that subjects taking the IRM course should have upon completion of the course. This test is found in Appendix C. Based on the results of this testing, we used a criterion based on *p*-values to select those items which would be most appropriate for inclusion in the final measurement instrument. *P*-values are the proportion of participants responding correctly to an item. *P*-values measure item difficulty (Dick and Hagerty, 1971:32). Maximum reliability occurs when item difficulty is 50 percent (Helmstadter, 1964:169; Guion, 1965:49). In an effort to maximize the reliability of the final measurement instrument, we selected items with *p*-values ranging from .25 to .75.

Due to the limited time available for course presentation, of which testing was a part, we decided to allot approximately 30 minutes of course time for each test administration. Reliability testing had shown that students were taking approximately 30 seconds to complete each question. Based on this finding and the time available for

testing, we determined the final test would contain 60 items. This test is found in Appendix D. Although longer tests are generally more reliable than shorter tests, we were forced to sacrifice the opportunity for better coverage of the course material by the above-mentioned time restrictions.

Adequacy of Content Sampling. Adequate coverage of the course material is a vital consideration in the development of a measurement instrument (DAF, 1993b:83). In order to ensure that the test covered the course material appropriately, we determined the relative importance of each of the course's seven modules. Specifically, the course developers made a subjective judgment as to the relative importance of each module. This importance was expressed as the percentage each module contributed to the course as a whole. Differences of opinion were openly discussed, and a consensus was reached on the final percentages. These percentages, listed in Table 2, were used to determine the number of questions from each course module that would be included in the measurement instrument.

Our selection criteria, based on choosing items with a *p*-value between .25 and .75 and the content sampling percentages listed in Table 2 did not yield a complete set of 60 items for the measurement instrument. Consequently, we selected additional items outside of the *p*-value criterion range to bring the total number of items to 60.

Table 2

Relative Importance of Modules

Module	Percent of Test Items
1	20
2	7
3	3
4	10
5	27
6	20
7	13

Reliability of Instrument. Reliability can be defined as the degree of consistency between two measures of the same thing (Mehrens and Lehmann, 1991:249). Test reliability may be defined as the degree to which errors of measurement influence test scores. Errors of measurement are those influences on test scores that are not related to the attribute being measured by a test scores. It is important to keep clearly in mind that test reliability deals with accuracy of measurement; it is only indirectly a measure of the usefulness or meaningfulness of that measure (Womer, 1968:30).

We used an internal-consistency estimate of reliability to determine the reliability of the instrument. Specifically, the Kuder-Richardson formula 20 was used to estimate the instrument's reliability. This formula, generally referred to as K-R 20, follows:

$$r_{tt} = (k/k\text{-}1)\ (\sigma_o^2 - \Sigma p_i q_i/\sigma_o^2) \quad (1)$$

where

k = number of items in the test
p_i = proportion of participants responding correctly to item i
q_i = 1 - p (or proportion of participants responding incorrectly)
σ_o^2 = test variance
$\Sigma p_i q_i$ = sum of p times q for all items (Dick and Hagerty, 1971:32).

K-R 20 (equation 1) measures the homogeneity of the items in a test and does not assess stability over time. Thus, it may be interpreted in the same fashion one would interpret Cronbach's alpha reliability coefficient (Womer, 1968:37). The estimates of reliability for the questions in our measurement instrument, broken out by module, are displayed in Table 3.

Standard Error of Measurement. The standard error of measurement is an additional concept which is important in any discussion of reliability. The standard error of measurement is a statistic that yields a score in the same units as the raw score of a test. The interpretation of the standard error of measurement is similar to that of the standard deviation of a set of test scores. The formula used to compute the standard error of measurement follows:

$$\sigma_{meas} = \sigma_o \sqrt{1 - r_{tt}} \quad (2)$$

where

σ_o = standard deviation of the test scores
r_{tt} = reliability estimate of the test (Dick and Hagerty, 1971:39).

Actual Values. The complete 60-item measurement instrument had an internal consistency estimate, or reliability, of 0.58 with a standard error of measurement of 3.26. This reliability estimate was derived from the values obtained from the 34 participants' scores on the 60 items included in the final measurement instrument. The following table summarizes the internal consistency estimates and standard errors of measurement for each module.

Table 3

Instrument Reliability Estimates and Standard Errors of Measurement

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6	Module 7
Reliability Estimate	.36	.09	-.41*	.38	.72	.07	-.80*
Std Error of Measurement	1.551	.9561	.7405	1.0122	1.7938	1.6476	1.3116
Maximum Possible Score	12	4	2	6	16	12	8

*Negative estimates are clearly artifacts of a lack of variance among the small sample; in all probability due to small sample size.

Administration of Course

The IRM course was administered over a three-day period, 24 October through 26 October 1994, at HQ AFMC, Wright-Patterson Air Force Base, Ohio. We administered the final measurement instrument to the six participants during the first hour of the first

day of instruction. Then, after the students had been exposed to the entire course of instruction, we re-administered the measurement instrument during the last hour of the final day of instruction. The students attended class from 0800 to 1200 hours each of the three days, receiving instruction from a different instructor each day.

Subjects. The six student participants were drawn from a sample which reasonably represented the target population for the instructional system. The course was designed to target mid-level Air Force information resources managers. Each of the subjects performed duties which could reasonably be included within the field of IRM. Likewise, each student held positions which could be considered to fall into the category of mid-level management.

Instructors. The three instructors were drawn directly from the available pool that is expected to form the population of instructors for the course. Specifically, each instructor was a student or graduate of the AFIT Graduate IRM program.

Summary of Methods

The design for this research was fitted within the framework of the Air Force ISD model. Working within this structure, we developed a measurement instrument and evaluated the IRM course quantitatively using a one-group pretest-posttest pre-experimental design. Additionally, we qualitatively evaluated the IRM course through the use of open-ended survey devices administered to the students and instructors.

III. Results and Discussion

Introduction

This section presents an analysis of the data gathered within the scope of our research and a discussion of findings resulting from this analysis. The first section provides analysis and discussion of qualitative data supplied by the students and instructors. The second section provides analysis and discussion of quantitative data gathered through the use of our test instrument.

Analysis and Discussion of Qualitative Data

We asked the students and instructors who participated in the administration of the IRM course to evaluate various aspects of the instructional system. The following sections summarize and discuss the student and instructor provided feedback.

Student Feedback. We asked the students to assess the relevance of the course content, the presentation of course materials, the value of the information presented, and the extent to which the defined course objectives were met. Table 4 provides a summary of their responses.

As a method of summative evaluation, the student comments provide a valuable resource in evaluating the IRM course. Summative evaluation provides an opportunity to evaluate an instructional system in whole. In as much as this administration of the course was its first, the student feedback provides an initial look at how the course as a whole can be improved.

Table 4

Summary of Student Feedback on IRM Course

Measure	+ or -	Comments
Relevance	+	Material was generally enlightening (i.e. new to the students)
	+	Provided a good overview of IRM processes
	-	Material should be less academically oriented
	-	Need to make a clearer tie to duty performance
	-	Some of the material was difficult to understand (Modules 6 and 7)
	-	Course needs a summary module to tie the material together
	-	Need to provide more military examples
Presentation	+	Slides and handouts were generally appropriate
	+	Instructors were knowledgeable and professional
	-	Student handouts had too many slides per page (hard to read)
	-	Need more exercises and case studies
	-	Slides need more color and graphics
	-	Having more than one instructor was distracting
Value	+	Felt more knowledgeable about IRM in general
	+	Anxious to share their learning in the workplace
	+	IRM concepts presented in course are important enough to be included in skills knowledge tests (SKT)
Met Objectives	+	Objectives, as stated within the course, were met
	-	Did not feel confident in the depth of IRM comprehension

Overall, the students seemed to feel that the content of the course was relevant to them as information resources managers. Likewise, their responses seem to indicate that the students were of the opinion that the course objectives were met. In addition, all students reported feeling as though the course had provided valuable information and knowledge.

However, the students were critical of some aspects of the instructional system. In general, the students felt that the course could be made more relevant to their needs by incorporating more military examples and case studies. Likewise, the students suggested an effort to make the orientation of the course more practical and less academic. Further, the students reported that the delivery of the course would be better if improvements were made to the slides and handouts. They reported that the slides needed more color and graphics.

Instructor Feedback. We also asked the instructors to assess the relevance of the course content, the presentation of course materials, and the extent to which the defined course objectives were met. Table 5 provides a summary of their responses.

Just as the students' feedback provided a mechanism for summative evaluation, so too did the instructors' comments. Without exception, the instructors felt that the course material was relevant to the target audience (mid-level information resources managers). Likewise, the three instructors agreed that course objectives were met. However, the instructors did provide suggestions for improving the course presentation and for making the course even more relevant. Specifically, the instructors indicated that the slides and instructor notes lack uniformity. They suggested providing all sections of instructor notes and slides in a consistent format. Likewise, they thought the slides should be incorporated into the notes to help the instructor associate particular slides with the appropriate supporting material in the notes.

Table 5

Summary of Instructor Feedback on IRM Course

Measure	+ or -	Comments
Relevance	+	Provides a good short overview of the disciplines of IRM
	+	Appropriate content for mid-level information resources managers
	-	Could improve relevance with more specific examples and case studies
Presentation	+	Course material was generally appropriate
	-	Instructor notes could be more uniform in format
	-	Instructor notes should incorporate the slides to provide better picture of what is to be presented
Met Objectives	+	Course objectives were met

Analysis and Discussion of Quantitative Data

Mean scores for the pretest and posttest were calculated for each of the seven modules. Dependent *t* tests were computed for each pretest-posttest matched pair to determine if the scores on the pretest were significantly lower than the scores on the posttest. The alpha level, *p*, of .20 was chosen for analyzing the individual modules due to the unusually small sample size with which we were working and because we had a commensurate need, in dealing with a new course, to improve statistical power. Table 6 shows that significant differences were found for five of the seven modules.

In all cases, the posttest scores were higher than the pretest scores, as evidenced by the percent increase column of Table 6. This would seem to indicate, at least for modules 1,2,3,5, and 6, that the course had a positive effect on the student's test scores. The overall test scores showed a positive increase of 34 percent from the pretest to the posttest. This difference was shown to be significant at an alpha level less than .005. However, this increase could be attributable to the "testing" effect, since they were exposed to the same instrument twice within a period of three days.

Table 6

Pretest/Posttest Scores: Descriptive Statistics and Tests of Significance Between Means

Module	% Increase	Mean Difference	Standard Deviation	*t* Statistic	*p*-value
1*	25.0	-1.0000	.5773	-1.73	.1438
2*	45.5	-0.8333	.5426	-1.54	.1852
3*	200.0	-0.6666	.2108	-3.16	.0250
4	50.0	-1.3333	.9189	-1.45	.2065
5*	18.2	-1.3333	.7601	-1.75	.1398
6*	42.3	-1.8333	.7923	-2.31	.0686
7	30.0	-1.0000	.8165	-1.22	.2752
Total Test**	34.0	-8.0000	1.6329	-4.90	.0045

*Significantly different ($p<.20$)
**Significantly different ($p<.005$)

Summary

This chapter presented an analysis and discussion of the qualitative and quantitative data gathered in during our research. The qualitative data, derived from surveys of the students and instructors, provided a mechanism for summatively evaluating

the IRM course. From this summative evaluation, we were able to identify potential improvements to the course. The quantitative data, gathered using the measurement instrument developed to evaluate how well the course meets its objectives, led to insight into the effectiveness of the instructional system.

IV. Conclusions and Recommendations

Introduction

Based on quantitative and qualitative data gathered regarding the administration of an IRM course, we have drawn conclusions about and developed recommendations for the course. In this chapter we will present our conclusions regarding course effectiveness based on an assessment of the quantitative and qualitative data presented in Chapter III. Afterwards, we will discuss the limitations of our research. Finally, we will discuss areas in need of further research, specifically addressing recommended changes to the measurement instrument and instructional system.

Conclusions

Quantitative Assessment. The difference in scores on the pretest and posttest seem to indicate that the students had a better understanding of the IRM concepts presented in the objectives of the course after being exposed to the course of instruction. However, many causes could explain reasons for the change, and other possibilities would have to be ruled out before a definitive statement about course effectiveness could be made. Even still, the significance of the change in total test scores does give confidence that a positive change in relevant knowledge about this discipline has occurred. In other words, although the effectiveness of particular portions of the course may be in question, as a whole, the course is effective.

Qualitative Assessment. Both instructors and students indicated that the course was basically sound and provided a useful overview of IRM concepts and principles for

practicing mid-level information resources managers. In particular, the students and instructors indicated that, in their opinions, the course objectives had been met. Based on the feedback from the groups, we feel confident that the course is a valuable tool for familiarizing managers with IRM concepts and principles. However, realizing that the students and instructors did provide some criticism of the instructional system, this version of the course may not be appropriate for field implementation until their concerns are addressed. In the recommendations section of this chapter, we will provide specific suggestions for how the instructional system can be made ready for operational deployment.

Limitations of the Research

Due to the nature of our research design, many factors cause uncertainty regarding the results of our study. Some of the more obvious problems we faced were small sample size, extraneous factors possibly affecting validity, possibly inadequate construction of the measurement instrument, and low reliability estimates.

Sample Size. We were only able to find six students who matched the course's intended audience to participate in this study. It is difficult to determine whether the data gathered from such a small group can provide meaningful information about the course. Likewise, the small sample used for our study could have caused problems such as the low reliability estimates discussed later.

Confounds. It is possible that extraneous factors may have influenced the validity of our quantitative assessment. Specifically, the effect of testing and reactivity could not be controlled in our design. The students may have scored higher on the posttest simply

because they were exposed to the measurement instrument twice within a period of three days and were more comfortable with the posttest. Another explanation is that the students were sensitized to the material covered by the pretest and paid particular attention to those topics as they were presented in the course. While sensitization to course material by the pretest may have caused the difference in test scores to be more pronounced, the very idea that sensitization could have influenced scores would imply the course is at least somewhat effective.

Instrument Construction. After completing our data collection, we discovered that we used what we now feel was an inappropriate criterion for selecting items to be included in the final version of the measurement instrument. Several authors suggest selecting items with an average *p*-value of .5 for a maximally discriminating measurement instrument (Guion, 1965:49; Helmstadter, 1964:169). Lord asserts, however, that for a multiple-choice item with five alternatives, an average *p*-value of .7 is more appropriate. He argues that having an easier test reduces the effect of chance guessing and increases reliability (Lord, 1952:193-194).

Reliability. Of the five modules that showed a significant increase in scores from the pretest to the posttest, only three had reliability estimates higher than .30. While it is impossible to set exact standards for judging reliability estimates, it is generally accepted that a reliability above .80 is satisfactory for judging the accuracy of individual scores. As a general rule, much lower reliability estimates are acceptable for judging the accuracy of a group of scores. However, with a reliability estimate of .30, we are approaching, if not already past, the point at which no conclusions can be drawn about the accuracy of the scores (Womer, 1968:41). The low reliability estimates could be attributable to the instability of small-N correlational estimates.

Recommendations

Several areas of this study could provide the basis for further research. The same design could be used with a larger group of students to determine if more meaningful results can be attained. In addition, another method of developing the measurement instrument could increase confidence in the accuracy of data gathered with it. Likewise, modifications to the instructional system could improve the overall results of future studies. Our suggestions for improvements to the measurement instrument and the instructional system follow.

Measurement Instrument. A new measurement instrument should be created using the criteria laid out in this chapter. We were able to develop a new measurement instrument using the original pool of questions surviving the validation process. We selected items using Lord's criterion of an average *p*-value of .7 and Mehrens and Lehmann's criterion of item-discrimination indices of at least .2. The item-discrimination index can be computed as follows:

$$\text{Discrimination} = \frac{R_U - R_L}{T/2} \tag{3}$$

where

R_U = number of students whose scores placed them above the 50th percentile for the test and who answered the item correctly
R_L = number of students whose scores placed them below the 50th percentile for the test and who answered the item correctly
T = total number of students tested (Mehrens and Lehmann, 1991:162).

We were able to find 43 items which met both criteria from our original pool of questions. The new instrument had an internal consistency estimate of .795 and a standard error of measurement of 3.36, which is considerably better than the original.

It is possible that, with minor revisions to the items in the pool and subsequent reliability testing, a longer instrument can be constructed with a reliability similar to, or better than, the 43 question instrument mentioned in the previous paragraph. Our review of literature has revealed that examining the alternatives within each item, or conducting distracter analysis, can provide insight into problems with the item (Mehrens and Lehmann, 1991:163). Due to time constraints, we did not perform distracter analysis on our pool of questions.

Instructional System. Our recommendations for improving the course are centered on upgrading the presentation of the course and adjusting the focus of course content.

Course Presentation. For the purpose of this study, the course was taught by a team of three instructors. A major complaint from the students involved in the study was that there was some confusion brought about by differences in each instructor's approach to the material. While sharing the teaching responsibilities may sometimes become necessary in the field, for the purpose of consistency, we recommend having one instructor teach all sections of the course; particularly in field testing the final version.

Likewise, we recommend that an effort be made to put all course materials, including slides, instructor notes and student handouts, into a more standard format. In particular, the layout, font sizes, and style of writing of all materials needs to be standardized. Both students and instructors commented on the lack of standardization within the pilot version of the course. Additionally, the incorporation of the course slides

into the instructor notes would allow instructors to more effectively prepare for course presentation.

Course Content. Minor revisions to course content could enhance the quality of the course greatly. The addition of case studies, illustrative examples, and classroom exercises to the course should allow the students to achieve a greater understanding of the concepts presented. In choosing the appropriate material for these additions, care should be taken to ensure the course is made more relevant for the people in the field. The pilot test feedback from the students criticised some of the current course materials for being "too academic" in orientation. We suggest changing the focus of course material from presentation of theory and knowledge to practical application. Another consideration is that the course was originally intended to last no longer than one week. We recommend additions be limited to meet this requirement unless it can be shown that the benefit of lengthening the course outweighs the added cost.

Appendix A: Student Feedback Form

Instructions: Please respond to the following questions as honestly and directly as possible. Your comments will provide valuable feedback which will be used to improve the content and presentation of this course. Remember, this is the first administration of the course material. Consequently, the course developers and the Air Staff are relying on your critique to help make this course more relevant and effective for future students.

How did you feel about the relevance of the content of this course? (Be as specific as possible.)

How did you feel about the presentation (slides, instruction, handouts) of this course? How could the presentation be improved?

Do you feel this course provided you with valuable information/knowledge? Why or Why not?

The purpose of this course was to familiarize you with basic IRM concepts and principles. To what extent do you feel this objective was met?

If you would like to provide additional comments, please do so here.

THANK YOU FOR YOUR FEEDBACK!

Capt Brenda Forcht and Lt Larry Cox

Appendix B: Instructor Feedback Form

Instructions: Please respond to the following questions as honestly and directly as possible. Your comments will provide valuable feedback which will be used to improve the content and presentation of this course. Remember, this is the first administration of the course material. Consequently, the course developers and the Air Staff are relying on your critique to help make this course more relevant and effective for future instructors and students.

How did you feel about the relevance of the content of this course? (Be as specific as possible.)

How did you feel about the course materials (slides, instructor notes, handouts)? Were they helpful? How could the course materials be improved?

The purpose of this course is to familiarize students with basic IRM concepts and principles. To what extent do you feel the course meets this objective?

If you would like to provide additional comments, please do so here.

THANK YOU FOR YOUR FEEDBACK!

Capt Brenda Forcht and Lt Larry Cox

Appendix C: 160-Item Measurement Instrument (Reliability Test)

1. Which of the following is NOT a cross life-cycle activity?

** 1. design
2. process management
3. measurement
4. documentation
5. feasibility analysis

2. Over half the workers in the U.S. today are:

1. directly involved in the manufacture of products.
** 2. knowledge workers.
3. blue-collar workers.
4. clerical and secretarial workers.
5. factory workers.

3. Which of the following best describes the concept of horizontal integration?

1. assuring information systems support business processes
** 2. spanning across functional boundaries
3. maintaining consistency throughout all phases of systems development
4. making various systems work cooperatively
5. deriving systems from information requirements

4. Why is risk assessment an important part of strategic planning?

1. Allows the organization to determine the level of risk it is willing to accept
2. Allows the organization to evaluate potential impact of opportunities & threats in the environment
3. Allows the organization to evaluate potential impact of strengths & weaknesses
4. Allows the organization to estimate the impact of strategic options
** 5. All of the above

5. In which phase of functional process improvement are opportunities identified based on an analysis of the AS-IS baseline?

1. execution
2. definition
** 3. preparation
4. data analysis
5. strategic planning

6. Which of the following is the graphical representation of a business process showing interactions and interdependencies between tasks (shows how a functional process works)?

1. data model
2. business model
** 3. activity model
4. information model
5. interaction model

7. Which of the following is NOT indicative of the manual processing phase of IRM evolution?

1. Records were kept on paper.
2. Data stores were physically located in offices.
3. Similar information was stored in multiple locations.
** 4. Firms had integrated databases.
5. Update, storage, and retrieval activities were performed manually.

8. Which of the following established the General Services Administration?

1. Brooks Act of 1965
2. Federal Records Act of 1968
3. Office of Management and Budget (OMB) Circular A-130
** 4. Federal Property and Administrative Services Act of 1949
5. Computer Security Act of 1987

9. What are critical success factors?

1. Skills and capabilities that are present in the organization
2. Estimates of future development and impact
3. Foundation to allow the organization to achieve its vision
** 4. Areas where success must be achieved in order to meet organizational goals
5. All of the above

10. For which of the following phases of the systems development life-cycle is end-user training and documentation an output?

1. analysis
2. design
** 3. implementation
4. planning
5. support

11. Which of the following is produced by or results from an activity?

1. input
2. control
3. entity
4. mechanism
** 5. output

12. The task of observing how business processes are carried out is characteristic of which phase of the systems development life-cycle?

** 1. analysis
2. design
3. implementation
4. planning
5. support

13. A system

1. uses its inputs economically in producing its outputs.
2. produces outputs that best meet the objectives of the system.
3. provides formal informational support to the members of the organization.
4. does not have subsystems.
** 5. is an organized, interacting, interdependent, and integrated set of components or variables that work together to achieve a common objective.

14. The advent of transaction processing systems is characteristic of which of the phases of IRM evolution?

1. manual processing phase
** 2. computer technology phase
3. personal computing phase
4. IRM phase
5. All of the above

15. For which of the following phases of the systems development life-cycle are user-identified systems problems a primary trigger?

1. analysis
2. design
3. implementation
4. planning
** 5. support

16. Which of the following is the application of a structured methodology to define a function's "AS-IS" environment, to include objectives and supporting strategies, and a program of incremental improvements made through functional, technical, and economic analysis and decision making.

1. business area analysis
2. value chain evaluation
3. critical success factor formulation
** 4. functional process improvement
5. competitive analysis

17. Which of the following establishes an individual's right to request information from federal agencies?

1. Privacy Act of 1974
** 2. Freedom of Information Act of 1966
3. Federal Records Act of 1968
4. Computer Security Act of 1987
5. Brooks Act of 1965

18. Which of the following is a primary output of the planning phase of systems development life-cycle?

1. business requirements statement
2. technical design statement
3. viable information system
4. existing system details and limitations
** 5. application development project

19. Which of the following factors does NOT influence an organization's environmental turbulence (pace of change)?

1. technology
2. competition
3. end-user computing
** 4. costs
5. environmental complexity

20. What was the underlying cause of the evolution of IRM concepts?

1. management information systems
2. economies of scale
3. automation of business processes
** 4. technology push and demand pull
5. boundary spanning

21. Which of the following is NOT characteristic of information?

1. Information is an increment of knowledge.
2. Information relies on the context and general knowledge of its recipient for its significance.
** 3. Information is considered a raw material.
4. Information is data that has meaning.
5. Information has real or perceived value.

22. A thing about which we wish to keep information is called a(n)

1. data relationship.
2. attribute.
3. subtype.
** 4. data entity.
5. supertype.

23. Which of the following activities is best described as ongoing procedures that establish standards for activities, methods, tools, and deliverables of the systems development life-cycle?

1. fact-finding
2. documentation
3. estimation
4. measurement
** 5. process management

24. Which of the following are decomposition diagrams that are incomplete or that violate the rules of activity analysis?

1. overview
2. context
3. primitive
4. systems
** 5. for exposition only

25. Which of the following refers to vertical integration?

1. assuring information systems support business processes
2. spanning across functional boundaries
3. maintaining consistency throughout all phases of systems development
** 4. 1 and 3 only
5. 1, 2, and 3

26. Which of the following has NOT evolved as a goal of IRM?

** 1. Prove the feasibility of organizational computing.
2. Maximize the benefit of information resources to the organization as a whole.
3. Strategic application of information resources
4. Shared information resources across functions
5. Functional management responsibility for systems requirements

27. Which of the following best describes the relationship between data and information?

** 1. Data is the raw material for information.
2. Data and information are essentially the same.
3. Data is more important than information.
4. Data is a subset of information.
5. Data has no relationship to information.

28. Why must systems be controlled?

1. systems exhibit differentiation
2. systems have inputs and outputs
3. components of a system interact
** 4. systems exhibit entropy
5. systems are goal-seeking

29. Which of the following is the primary output of the implementation phase of systems development life-cycle?

1. business requirements statement
2. technical design statement
** 3. viable information system
4. existing system details and limitations
5. application development project

30. In which phase of information engineering are organizational mission and structure defined?

** 1. planning
2. analysis
3. design
4. construction
5. engineering

31. Which of the following applies to the Paperwork Reauthorization Act of 1986?

1. Required development and revision of five-year plans to meet information technology needs.
2. Provided the primary set of regulations for governing federal management, acquisition, and use of information technology
3. Required maintenance of a comprehensive set of IRM policies
** 4. 1 and 3 only
5. 1, 2, and 3

32. Which these is performed during the analysis phase of information engineering?

1. identification of organizational goals and objectives
** 2. development of functional groups
3. translation of logical models into physical models
4. implementation of information systems projects
5. development of high-level process and data models

33. Which of these is performed during the design phase of information engineering?

1. development of entity-relationship diagrams
2. development of functional groups
** 3. translation of logical models into physical models
4. implementation of information systems projects
5. development of high-level process and data models

34. Information engineering is an integrated process. Which of the following best describes how this integration is accomplished?

1. organizational goals are identified in a bottom-up fashion
2. systems are developed to support information requirements
3. information requirements are derived from organizational goals
** 4. 2 and 3 only
5. 1, 2, and 3

35. Which of the following refers to the ongoing study of a problem environment to identify problem-solving possibilities?

1. analysis
** 2. planning
3. design
4. implementation
5. support

36. Good data management is a tenet of IRM. Which of the following is NOT an element of good data management?

1. data elements mean the same thing to everyone in the organization
** 2. data elements are flexibly defined to meet situational requirements
3. someone must be responsible for the data
4. everyone who needs and has a right to data should be able to access it
5. None of the above (All are elements of good data management.)

37. Which of the following are potential benefits of strategic planning?

1. minimized risk
2. improved resource utilization
3. reduced redundancy
4. improved flexibility
** 5. All of the above

38. The environment consists of those things which surround and affect a system. Which of the following could be part of a systems environment?

1. regulations
2. directives
3. customers
4. laws
** 5. All of the above

39. Which of the following does NOT contribute to the need for strategic planning?

1. environmental instability
2. desire to integrate business functions
** 3. predictable future events
4. rapidly changing technology
5. desire to identify business opportunities

40. The creeping commitment approach to systems development advocates which of the following?

1. Only incurred costs should be considered when reevaluating project feasibility.
2. Both incurred and future costs should be considered when reevaluating project feasibility.
** 3. Costs that have already been incurred are irrelevant in the project continuation decision.
4. In each phase of the systems development life-cycle, systems analysts decide whether or not additional user requirements will be supported by the new information system.
5. All costs are irrelevant when reevaluating project feasibility.

41. Information must be available when needed. This statement refers to which of the following characteristics of information?

1. relevance
2. frequency of use
3. time horizon
** 4. timeliness
5. organization

42. Which of the following activities is best described as the measurement of how beneficial the development of an information system would be to an organization?

** 1. feasibility analysis
2. documentation
3. estimation
4. measurement
5. process management

43. Which phase of information engineering features automated software coding?

1. planning
2. analysis
3. design
** 4. construction
5. engineering

44. Which of the following defines the future direction of the organization?

** 1. vision statement
2. mission statement
3. goals
4. objectives
5. strategies

45. Which of the following is a goal of CIM?

** 1. tie DoD organizations together through common, shared data
2. place increased emphasis on information technology acquisition
3. implement a rigid world-wide information infrastructure
4. minimize duplication through increased automation
5. All of the above

46. Which of the following is a form of cost accounting that focuses on the costs of performing a functional process rather than on the costs associated with an organizational unit?

1. job order costing
2. financial accounting
3. process costing
** 4. activity based costing
5. business costing

47. Which is NOT an example of information?

1. The Ajax Company owes $4000 to the ABC Company.
2. Mr. Smith's office telephone number is 555-4567.
3. The suggested retail price of a Ford Taurus is $17,000.
** 4. The numbers 876, 315, and 4704.
5. The personnel manager's social security number is 223-34-4987.

48. Which of the following is true about the relationship between the formal and informal organizations?

1. the formal organization has more rules than the informal organization
2. the informal organization is less structured than the formal organization
** 3. the informal organization is the social interaction within the structure of the formal organization
4. 1 and 2 only
5. 1, 2, and 3

49. Which of the following is most likely a knowledge worker?

1. factory worker
2. construction worker
3. data entry clerk
4. sales clerk
** 5. financial consultant

50. Information must address the needs of the user. This statement refers to which of the following characteristics of information?

1. timeliness
** 2. relevance
3. source
4. level of aggregation
5. time horizon

51. In which of the phases of functional process improvement are the action, transition and project plans put into motion and the improvement package implemented?

** 1. execution
2. definition
3. preparation
4. data analysis
5. strategic planning

52. Which of the following is NOT an example of a mechanism?

1. machines
2. facilities
** 3. regulations
4. systems
5. personnel

53. Which of the following does NOT describe the duties of the General Accounting Office?

1. Independently observes government programs
2. Audits government contractors and procuring agencies
3. Issues decisions on bid protests
** 4. Monitors compliance with government-wide IRM policies
5. Investigates federal ADP policy, use, and procurement

54. Which of the following agencies maintains and amends the procurement and contracting portions of the Federal Information Resources Management Regulations (FIRMR)?

** 1. General Services Administration
2. General Accounting Office
3. Office of Management and Budget
4. Defense Information Services Agency
5. Office of Resource Management

55. Environmental analysis does NOT include which of the following?

1. identification of threats.
2. identification of opportunities.
3. inventory of current resources.
** 4. identification of major products and services.
5. consideration of pending legislation.

56. Which of the following is NOT a step in performing a functional economic analysis?

1. statement of objective
2. sensitivity analysis
3. cost/benefit analysis
** 4. cost-volume-profit analysis
5. identification of alternatives

57. Information engineering methodology stresses which of the following?

1. customer involvement
2. top-down partitioning of models
3. quick completion of systems
4. business focus
** 5. All of the above

58. The rule that defines the maximum number of occurrences of one entity for a single occurrence of the related entity is called

1. normalization.
** 2. cardinality.
3. entity supertype.
4. data analysis.
5. ordinality.

59. Which of the following is a requirement for successful functional process improvement?

1. senior leadership support
2. organized and trained project teams
3. architectures in place
4. formalized implementation strategy and procedures
** 5. All of the above

60. Which of the following shows the current (baseline) structure of a functional process?

1. data model
2. implementation model
** 3. AS-IS model
4. essential model
5. TO-BE model

61. Which of the following involves the ability to break a large business problem down into its component parts, analyze the various aspects of the problem, and then assemble a system to solve the problem?

1. general business knowledge
2. systems analysis and design skills
3. computer programming experience and expertise
** 4. problem-solving skills
5. interpersonal relations skills

62. For which of the following phases of the systems development life-cycle are business and information system plans a key output?

1. analysis
2. design
3. implementation
** 4. planning
5. support

63. Which of the following agencies is the key monitor of federal automated data processing equipment (ADPE) procurement?

** 1. General Services Administration
2. General Accounting Office
3. Office of Management and Budget
4. Federal Contracting Agency
5. Office of Resource Management

64. An attribute or group of attributes that uniquely identifies one and only one occurrence of an entity is called a(n)

1. data relationship.
2. subtype.
** 3. key attribute.
4. data entity.
5. supertype.

65. Something that will limit flexibility in defining a solution to meet objectives is called a(n)

1. mechanism.
2. directive.
** 3. control.
4. problem.
5. opportunity.

66. Which of the following is NOT a characteristic of information engineering methodology?

1. enterprise-wide perspective
2. business focus
** 3. bottom-up identification of information requirements
4. automated systems development
5. integrated systems development

67. Which of the following defines the scope, mission, business objectives, organizational structure, duties and responsibilities, and management strategy for process improvement?

1. business plan
** 2. functional architecture
3. organization chart
4. directives
5. None of the above

68. What does a strategic plan define?

1. products and services
2. mission
3. customers
4. values and beliefs
** 5. All of the above

69. Which of the following shows the objective (target) structure of a functional process?

1. data model
2. implementation model
3. AS-IS model
4. essential model
** 5. TO-BE model

70. Which of the following is the primary output of the design phase of systems development life-cycle?

1. business requirements statement
** 2. technical design statement
3. viable information system
4. existing system details and limitations
5. application development project

71. The Brooks Act gave which of the following agencies fiscal and policy control over procurement and management of ADPE?

1. General Services Administration
2. General Accounting Office
** 3. Office of Management and Budget
4. Defense Information Services Agency
5. Internal Revenue Service

72. Which of the following would be accomplished during functional economic analysis?

1. identify improvement alternatives
2. identify cost of improvement alternatives
3. choose among improvement alternatives
4. determine the consequences of past decisions
** 5. All of the above

73. Which of the following is NOT a problem associated with the manual processing phase of IRM evolution?

** 1. Management was investing heavily in information technology.
2. Multiple files and copies had to be maintained.
3. Users had to physically locate the data store containing need information.
4. Data stores and reports lacked concurrency.
5. Creation and maintenance of data stores was costly and time consuming.

74. Which of the following is NOT a hallmark of an information society?

1. increased turbulence
** 2. increased number of industrial jobs
3. dramatic increase of available knowledge
4. growth of complexity
5. All of the above are hallmarks of an information society.

75. Which of the following disciplines did NOT contribute to the evolution of IRM?

1. Systems Theory
2. Accounting
3. Cognitive Science
4. Management and Organizational Theory
** 5. None of the above (All contributed to the evolution of IRM)

76. Which of the following is NOT a business process improvement (BPI) method?

1. activity models
2. data models
3. functional economic analysis
** 4. information engineering
5. activity based costing

77. Which of the following is NOT true of information engineering?

1. supports the entire systems development life-cycle
2. seeks to integrate systems across the value chain
3. is data-centered and data-driven
** 4. is designed to develop software for individual systems
5. seeks to streamline organizational procedures

78. What is a source of demand pull?

1. the drive to automate an organization
2. innovations in information technology
3. growing complexity of social organizations
** 4. needs in the marketplace
5. evolution of IRM concepts

79. Which of the following is the primary output of the analysis phase of systems development life-cycle?

** 1. business requirements statement
2. technical design statement
3. viable information system
4. existing system details and limitations
5. application development project

80. Which of the following agencies investigates federal automated data processing equipment (ADPE) policy, use, and procurement?

1. General Services Administration
** 2. General Accounting Office
3. Office of Management and Budget
4. Federal Contracting Agency
5. All of the above

81. In which phase of the systems development life-cycle are information systems applications identified and prioritized?

1. analysis
2. design
3. implementation
4. support
** 5. planning

82. Which of the following diagram types shows the scope of an activity and the major inputs, controls, outputs, and mechanisms in an activity?

1. overview
** 2. context
3. primitive
4. systems
5. for exposition only

83. Which of the following has contributed to an increase in available knowledge?

1. increased number of professional and trade journals
2. increased volume of private and public sector communications
3. increased access to computerized data stores
4. Both 1 and 3 have contributed.
** 5. All of the above have contributed.

84. Which of the following is performed during the construction phase of information engineering?

1. development of entity-relationship diagrams
2. development of functional groups
3. translation of logical models into physical models
** 4. implementation of information systems projects
5. development of high-level process and data models

85. Which of the following is NOT a trigger for a systems development project?

1. problems
** 2. feasibility assessments
3. opportunities
4. directives
5. All of the above

86. Which of the following is NOT an element of a strategic plan?

** 1. operating instructions (OI)
2. vision statement
3. mission statement
4. critical success factors
5. goals

87. Which was NOT a major outcome of the Paperwork Reduction Act of 1980?

1. Formally established the concept of IRM within the federal government
2. Made each agency responsible for following Office of Management and Budget (OMB) information policy guidance
3. Assigned central information management responsibility to GSA
** 4. Required federal agencies to establish multi-year strategic plans
5. Mandated that each agency designate a single senior official to carry out responsibilities under the act

88. After investigating the issue of information and federal agencies, the Congressional Committee on Federal Paperwork did which of the following?

1. Formally established the concept of IRM within federal government.
2. Created the Office of Management and Budget.
3. Assigned central information management responsibility to the GS1.
4. Provided a framework for managing federal information resources.
** 5. Concluded that information is a valuable national resource.

89. Which of the following is part of the environmental analysis stage of strategic planning process?

** 1. identification of internal strengths and weaknesses
2. definition of organizational mission
3. development of organizational strategies
4. creation of organizational vision statement
5. All of the above

90. In which of the phases of functional process improvement are objectives and corresponding strategies established?

1. execution
** 2. definition
3. preparation
4. data analysis
5. strategic planning

91. Which of the following defines how the organizational mission will be carried out?

1. goals
2. objectives
3. strategies
4. critical success factors
** 5. 1, 2, and 3 only

92. Which of the following is the most important strategic resource of the Information Age?

** 1. information
2. labor
3. time
4. capital
5. money

93. The task of obtaining information (or fact-finding) is characteristic of which phase of the systems development life-cycle?

1. analysis
2. design
3. implementation
4. planning
** 5. All of the above

94. What is benchmarking?

1. Identifying those things that must go right for the mission to succeed
2. Identifying the current level of productivity within the organization
** 3. Identifying comparative measures in the products and processes of the organization
4. Identifying those things that are necessary for the organization to stay competitive
5. Both 2 and 4

95. Raw facts in isolation that are not useful by themselves are called

** 1. data.
2. attributes.
3. data flow.
4. information.
5. entity.

96. Which of the following concepts is best described as activities that overlap many or all phases of the systems development life-cycle?

1. analysis activities
2. design activities
3. implementation activities
4. planning activities
** 5. cross life-cycle activities

97. Which of the following is NOT part of the Functional Process Improvement Program vision?

** 1. multiple interfaces
2. shared information
3. functional leadership
4. reusable technology
5. mission support

98. Which of the following is performed during the planning phase of information engineering?

1. development of entity-relationship diagrams
2. development of functional groups
3. translation of logical models into physical models
4. implementation of information systems projects
** 5. development of high-level process and data models

99. Which of the following participate in a systems development life-cycle?

1. system analysts
2. software engineers
3. programmers
4. end-users
** 5. All of the above

100. The natural association that exists between one or more entities is called a(n)

1. attribute.
2. supertype.
** 3. data relationship.
4. identifier.
5. subtype.

101. Of the triggers for a systems development project, which is best described as a chance to improve the organization?

1. problem
** 2. opportunity
3. feasibility assessment
4. directive
5. None of the above

102. Which of the following is an example of a control?

1. machines
2. facilities
** 3. regulations
4. systems
5. personnel

103. The Federal Information Resources Management Regulations (FIRMR) does NOT do which of the following?

** 1. Assign General Services Administration a central management role in government-wide records management.
2. Provide the primary set of regulations for governing federal management, acquisition, and use of information technology
3. Supplement general procurement and contracting regulations contained in the Federal Acquisition Regulations (FAR)
4. Introduce compliance policies pertaining to IRM and provisions of public laws
5. None of the above (all describe the FIRMR)

104. Which of the following is a business case decision package that documents and justifies a proposed improvement action?

1. financial analysis
2. feasibility assessment
** 3. functional economic analysis
4. value chain assessment
5. competitive analysis

105. Which of the following systems development life-cycle principles implies that a systems project must be evaluated for cost effectiveness?

1. Get the user involved.
2. Establish phases and activities.
** 3. Justify systems as capital investments.
4. Establish standards for consistent development and documentation.
5. Don't be afraid to cancel or revise scope.

106. Which of the following is data or material that is transformed in an activity?

** 1. input
2. control
3. entity
4. mechanism
5. output

107. Which of the following is NOT a CIM implementation principle?

1. Information will be managed through centralized control and decentralized execution.
** 2. Automation is preferred to simplification through elimination and integration.
3. Business methods should be routinely scrutinized by cost-benefit analysis to include benchmarking.
4. The computer/communication infrastructure should be transparent to users.
5. Functional management is responsible for benefits and costs of information systems.

108. Which of the following activities is best described as recording facts and specifications for a system?

1. fact-finding
** 2. documentation
3. estimation
4. measurement
5. process management

109. Of the triggers for a systems development project, which is best described as a requirement that is imposed by management, government, or some external influence?

1. problem
2. opportunity
3. feasibility assessment
** 4. directive
5. threat

110. Which of the following activities is best described as the process of using research, interviews, meetings, and other techniques to collect information about systems, requirements, and preferences?

** 1. fact-finding
2. documentation
3. estimation
4. measurement
5. process management

111. Which of the following is a resource that is used to turn an input into an output?

1. input
2. control
3. entity
** 4. mechanism
5. output

112. Which of the following is a benefit of I-CASE tool use in information engineering?

** 1. improved identification of information requirements
2. streamlined business processes
3. improved business focus
4. improved customer focus
5. All of the above

113. Information can be a productivity multiplier. Which of the following does NOT demonstrate this principle.

** 1. data entry
2. coordinating activities
3. boundary spanning
4. decision support
5. modeling

114. Which of the following is a CIM strategy?

** 1. Develop and implement cost effective, common information systems based on process models and data standards.
2. Develop and implement a computer/communication infrastructure based on closed system principles.
3. Develop data standards with emphasis on departmental segregation.
4. Manage information through decentralized control and centralized execution.
5. All of the above

115. Business process improvement principles dictate that non-value added activities be addressed in which of the following ways?

1. Non-value added activities should always be automated.
2. Non-value added activities should be streamlined and simplified.
** 3. Non-value added activities should be eliminated when not mandated by regulation or higher authority.
4. Non-value added activities should be modeled but not streamlined.
5. Non-value added activities should not be considered during business process improvement efforts.

116. Which of the following constrains, regulates, directs, and/or focuses, an activity?

1. input
** 2. control
3. entity
4. mechanism
5. output

117. Which of the following activities is best described as the packaging of documentation for review by interested users and managers?

1. fact-finding
** 2. presentation
3. estimation
4. project management
5. process management

118. Which of the following systems can be linked to the evolution of IRM?

1. management reporting system
2. decision support system
3. executive information system
4. transaction processing system
** 5. All of the above can be linked to the evolution of IRM.

119. Which of the following is NOT required of the organization in response to the shift to an information-based society?

** 1. large scale investment in information technology
2. continuous product and process innovation
3. constant internal organizational renewal
4. protection from information overload
5. organizational design for knowledge work and decision making

120. Why is IRM strategic planning important to an organization?

** 1. IRM directly supports the organizational mission
2. All functions must have a strategic plan
3. IRM strategic plan is the foundation for the organizational strategic plan
4. IRM strategic plan is the primary input for acquisitions planning
5. All of the above

121. Distinct activities that have inputs and outputs and may be implemented by people, machines, or computers are

** 1. business processes.
2. computer processes.
3. functions.
4. transactions.
5. data flows.

122. A data modeling tool that depicts the associations among different categories of data within a business is called a(n)

1. data flow diagram.
2. model.
3. implementation model.
4. connectivity diagram.
** 5. entity relationship diagram.

123. Facts that have been manipulated so they are useful to someone are called

1. data.
2. attributes.
3. data flow.
** 4. information.
5. entity.

124. Which of the following provided a government-wide policy framework for managing federal information resources?

1. Brooks Act
2. Federal Records Act
** 3. Office of Management and Budget (OMB) Circular A-130
4. Federal Property and Administrative Services Act
5. Federal Information Resources Management Regulations (FIRMR)

125. Which of the following is NOT a primary benefit of information engineering using an I-CASE tool?

1. quicker systems development
2. reduced maintenance costs
3. improved software portability
4. increased mission support
** 5. None of the above

126. Which of the following is inconsistent with CIM principles?

1. Information will be managed through centralized control and decentralized execution.
** 2. Common data definitions and standards should be developed locally.
3. Systems should be acquired through competitive bidding considering internal and external sources.
4. Data should be entered only once.
5. Interfaces should be friendly and consistent.

127. What key event sparked the need for the development of IRM methodologies?

1. the discovery of new information storage methods
2. the application of computer resources to information processing tasks
3. the advent of organizational-wide personal computer use
** 4. information was recognized as a corporate resource
5. All of the above

128. The basic unit in activity modeling is called a(n)

1. entity.
** 2. ICOM.
3. attribute.
4. function.
5. data flow.

129. Which of the following is NOT a consequence of poor planning?

1. redundancy
** 2. proactive rather than reactive management
3. suboptimization
4. 1 and 3 only
5. 1, 2, and 3

130. Which of the following is NOT a basic principle of systems theory?

1. components of a system interact
** 2. systems consist of uniform components
3. systems form a hierarchy
4. systems exhibit entropy
5. systems transform inputs into outputs

131. Which of the following is NOT a strategy of the CIM program?

1. Develop and implement cost effective, common information systems based on process models and data standards.
2. Manage expenditures for information regardless of the technology applied.
3. Apply CIM to integrate DoD-wide operations.
4. Minimize duplication and enhance DoD information systems.
** 5. Enhance DoD information systems without regard to cost reduction targets.

132. Which of the following is NOT true of an IRM strategic plan?

** 1. It is formulated to evaluate the current state of technology
2. It is derived from and supports the organization's strategic plan
3. It sets the broad direction and goals for managing information within the organization
4. It presents strategies to position the agency to take full advantage of the exploitation of technology
5. None of the above (all are true)

133. Which of the following is the graphical representation of information and data assets expressed in terms of entities and relationships?

** 1. data model
2. business model
3. activity model
4. information model
5. interaction model

134. Which of the following laws established an individual's right to review federal records containing personal information about him/her maintained by federal agencies?

** 1. Privacy Act of 1974
2. Freedom of Information Act of 1966
3. Federal Records Act of 1968
4. Computer Security Act of 1987
5. Brooks Act of 1965

135. Which of the following is a valuable corporate resource?

1. money
2. time
3. information
4. people
** 5. All of the above are valuable corporate resources.

136. Which of the following agencies exerts general supervisory control over the budgetary activities of executive agencies?

1. General Services Administration
2. General Accounting Office
** 3. Office of Management and Budget
4. Defense Information Services Agency
5. Internal Revenue Service

137. Which of the following is NOT an important component of functional process improvement efforts?

1. activity modeling
** 2. information engineering
3. benchmarking
4. activity based costing
5. data modeling

138. Which of the following is NOT a CIM guiding principle?

1. Customers define process improvements and system requirements, manage information and measure results.
2. Business processes must be simplified and improved before they can be automated.
** 3. Information will be managed through decentralized control and centralized execution.
4. The fastest progress, at lowest risk, is achieved by evolution not revolution.
5. None of the above

139. Which is NOT a principle of systems development?

1. Get the user involved.
2. Establish phases and activities.
3. Establish standards for consistent development and documentation.
** 4. Develop systems in a sequential manner.
5. Don't be afraid to cancel or revise scope.

140. Which of the following are appropriate responses to the changes brought about by the transition to an information society?

1. protection from information overload and decreased flexibility
** 2. continuous product and process innovation
3. increased structure and decreased flexibility
4. implicit mechanisms for acquisition of information systems
5. organizational design for office automation

141. Which of the following systems development life-cycle principles reveals strengths and weaknesses of the system before the system is built, stimulates user involvement, and reassures management about progress?

1. Get user involved.
2. Establish phases and activities.
** 3. Establish standards for consistent development and documentation.
4. Use a problem-solving approach.
5. Don't be afraid to cancel or revise scope.

142. The process followed in developing a new information system for an organization is referred to as which of the following?

1. systems analysis and design
2. program development life-cycle
** 3. systems development life-cycle
4. problem solving
5. business process reengineering

143. What defines how the mission will be accomplished in accordance with organizational values and beliefs?

** 1. vision statement
2. mission statement
3. goals
4. objectives
5. strategies

144. Ad hoc computing was a major problem of which of the phases of IRM evolution?

1. manual processing phase
2. computer technology phase
** 3. personal computing phase
4. IRM phase
5. All of the above

145. Which of the following was the most important strategic resource of the Industrial Age?

1. information
2. labor
3. time
** 4. capital
5. money

146. Information has all of the following special qualities EXCEPT that it

1. is not consumed.
** 2. does not age.
3. must be provided in a timely manner.
4. loses its value over time.
5. must be managed.

147. What is the source of technology push?

1. the drive to automate an organization
** 2. innovations in information technology
3. growing complexity of social organizations
4. needs in the marketplace
5. evolution of IRM concepts

148. Characteristics that are common to all or most instances of a particular entity are called

** 1. data attributes.
2. identifiers.
3. data relationships.
4. subtypes.
5. associative entities.

149. In which of the following phases are software packages installed?

1. planning
2. analysis
3. support
** 4. implementation
5. design

150. What primary role does functional economic analysis (FEA) play in business process improvement efforts?

1. The FEA determines the correct alternative solution.
2. The FEA details how solution alternatives compare to competitors' best business practices.
3. The FEA provides data about the cost of performing the activities that are part of the process being modeled.
** 4. The FEA provides a format for presenting solution alternatives for management consideration.
5. The FEA does all of the above.

151. Of the triggers for a systems development project, which is best described as an undesirable situation that prevents an organization from achieving its purpose, goals, and objectives?

** 1. problem
2. opportunity
3. feasibility assessment
4. directive
5. policy

152. Which of the following Congressional initiatives officially introduced information resources management (IRM) to federal agencies?

1. Privacy Act of 1974
** 2. Paperwork Reduction Act of 1980
3. Brooks Act of 1965
4. Fairness in Contracting Act
5. Government Performance and Results Act of 1993

153. Which of the following is true of an organization?

1. An organization is a group of individuals.
2. An organization is rationally coordinated.
3. An organization's members work toward a common goal.
4. An organization's members often conform to formal and informal standards.
** 5. All of the above

154. Which of the following is NOT a key element of business process improvement (BPI)?

1. identifying and eliminating non-value added activities
2. emphasizing reuse of assets
3. automating only after underlying process have been improved
4. integrating processes, physical assets, organizations, and data
** 5. simplifying and streamlining non-value added activities

155. Which of the following is the objective of the CIM program?

** 1. Increase military effectiveness
2. Create models of all DoD processes
3. Use information technology to achieve cost reductions and improve efficiency
4. Develop a common methodology for systems development
5. Provide justification for information technology investments

156. Which of the following factors is likely to contribute to the increasing complexity of organizational decision-making?

1. politics
2. economics
3. regulation
4. culture
** 5. All of the above

157. Which of the following evaluation criteria is concerned with tangible and intangible benefits of a systems solution?

** 1. economic feasibility
2. operational feasibility
3. technical feasibility
4. schedule feasibility
5. political feasibility

158. In which phase of the systems development life-cycle is a computer-based technical solution devised?

1. analysis
** 2. design
3. implementation
4. planning
5. support

159. Which of the following defines the purpose of the organization?

1. vision statement
** 2. mission statement
3. goals
4. objectives
5. strategies

160. According to the Paperwork Reduction Act, the director of the Office of Management and Budget (OMB) has authority to do which of the following?

1. Develop and implement government-wide IRM policies
2. Oversee the development and use of information management principles, standards, and guidelines
3. Evaluate agency information management practices
4. Monitor agency compliance with Office of Management and Budget (OMB) information management policies
** 5. All of the above

Appendix D: 60-Item Measurement Instrument (Pretest/Posttest)

1. Being available when needed refers to which of the characteristics of information?

1. relevance
2. frequency of use
3. time horizon
** 4. timeliness
5. organization

2. Which of the following is a business case decision package that documents and justifies a proposed improvement action?

1. financial analysis
2. feasibility assessment
** 3. functional economic analysis
4. value chain assessment
5. competitive analysis

3. Which of the following activities is best described as the measurement of how beneficial the development of an information system would be to an organization?

** 1. feasibility analysis
2. documentation
3. estimation
4. measurement
5. process management

4. A thing about which we wish to keep information is called a(n)

1. data relationship.
2. attribute.
3. subtype.
** 4. data entity.
5. supertype.

5. Which of the following best describes the concept of horizontal integration?

1. assuring information systems support business processes
** 2. spanning across functional boundaries
3. maintaining consistency throughout all phases of systems development
4. making various systems work cooperatively
5. deriving systems from information requirements

6. Something that will limit flexibility in defining a solution to meet objectives is called a(n)

1. mechanism.
2. directive.
** 3. control.
4. problem.
5. opportunity.

7. The task of obtaining information (or fact-finding) is characteristic of which phase of the systems development life-cycle?

1. analysis
2. design
3. implementation
4. planning
** 5. All of the above

8. Information engineering is an integrated process. Which of the following best describes how this integration is accomplished?

1. organizational goals are identified in a bottom-up fashion
2. systems are developed to support information requirements
3. information requirements are derived from organizational goals
** 4. 2 and 3 only
5. 1, 2, and 3

9. For which of the following phases of the systems development life-cycle is end-user training and documentation an output?

1. analysis
2. design
** 3. implementation
4. planning
5. support

10. Which of the following activities is best described as ongoing procedures that establish standards for activities, methods, tools, and deliverables of the systems development life-cycle?

1. fact-finding
2. documentation
3. estimation
4. measurement

** 5. process management

11. Which of the following evaluation criteria is concerned with tangible and intangible benefits of a systems solution?

** 1. economic feasibility
2. operational feasibility
3. technical feasibility
4. schedule feasibility
5. political feasibility

12. Which of the following refers to vertical integration?

1. assuring information systems support business processes
2. spanning across functional boundaries
3. maintaining consistency throughout all phases of systems development

** 4. 1 and 3 only
5. 1, 2, and 3

13. A data modeling tool that depicts the associations among different categories of data within a business is called a(n)

1. data flow diagram.
2. model.
3. implementation model.
4. connectivity diagram.

** 5. entity relationship diagram.

14. Which of the following diagram types shows the scope of an activity and the major inputs, controls, outputs, and mechanisms in an activity?

1. overview

** 2. context
3. primitive
4. systems
5. for exposition only

15. Which of the following is true about the relationship between the formal and informal organizations?

1. the formal organization has more rules than the informal organization
2. the informal organization is less structured than the formal organization
** 3. the informal organization is the social interaction within the structure of the formal organization
4. 1 and 2 only
5. 1, 2, and 3

16. In which phase of the systems development life-cycle are information systems applications identified and prioritized?

1. analysis
2. design
3. implementation
4. support
** 5. planning

17. Which of the following is NOT part of the Functional Process Improvement Program vision?

** 1. multiple interfaces
2. shared information
3. functional leadership
4. reusable technology
5. mission support

18. Which of the following Congressional initiatives officially introduced information resources management (IRM) to federal agencies?

1. Privacy Act of 1974
** 2. Paperwork Reduction Act of 1980
3. Brooks Act of 1965
4. Fairness in Contracting Act
5. Government Performance and Results Act of 1993

19. Which of the following is the application of a structured methodology to define a function's "AS-IS" environment, to include objectives and supporting strategies, and a program of incremental improvements made through functional, technical, and economic analysis and decision making?

1. business area analysis
2. value chain evaluation
3. critical success factor formulation
** 4. functional process improvement
5. competitive analysis

20. Which of the following are appropriate responses to the changes brought about by the transition to an information society?

1. protection from information overload and decreased flexibility
** 2. continuous product and process innovation
3. increased structure and decreased flexibility
4. implicit mechanisms for acquisition of information systems
5. organizational design for office automation

21. Environmental analysis does NOT include which of the following?

1. identification of threats.
2. identification of opportunities.
3. inventory of current resources.
** 4. identification of major products and services.
5. consideration of pending legislation.

22. Which of the following agencies is the key monitor of federal automated data processing equipment (ADPE) procurement?

** 1. General Services Administration
2. General Accounting Office
3. Office of Management and Budget
4. Federal Contracting Agency
5. Office of Resource Management

23. The rule that defines the maximum number of occurrences of one entity for a single occurrence of the related entity is called

1. normalization.
** 2. cardinality.
3. entity supertype.
4. data analysis.
5. ordinality.

24. Which of the following would be accomplished during functional economic analysis?

1. identify improvement alternatives
2. identify cost of improvement alternatives
3. choose among improvement alternatives
4. determine the consequences of past decisions
** 5. All of the above

25. Characteristics that are common to all or most instances of a particular entity are called

** 1. data attributes.
2. identifiers.
3. data relationships.
4. subtypes.
5. associative entities.

26. Which of the following is a form of cost accounting that focuses on the costs of performing a functional process rather than on the costs associated with an organizational unit?

1. job order costing
2. financial accounting
3. process costing
** 4. activity based costing
5. business costing

27. Which is NOT a principle of systems development?

1. Get the user involved.
2. Establish phases and activities.
3. Establish standards for consistent development and documentation.
** 4. Develop systems in a sequential manner.
5. Don't be afraid to cancel or revise scope.

28. Information has all of the following special qualities EXCEPT that it

1. is not consumed.
** 2. does not age.
3. must be provided in a timely manner.
4. loses its value over time.
5. must be managed.

29. Which of the following is NOT an important component of functional process improvement efforts?

1. activity modeling
** 2. information engineering
3. benchmarking
4. activity based costing
5. data modeling

30. Which of the following is NOT true of an IRM strategic plan?

** 1. It is formulated to evaluate the current state of technology
2. It is derived from and supports the organization's strategic plan
3. It sets the broad direction and goals for managing information within the organization
4. It presents strategies to position the agency to take full advantage of the exploitation of technology
5. None of the above (all are true)

31. Which of the following are decomposition diagrams that are incomplete or that violate the rules of activity analysis?

1. overview
2. context
3. primitive
4. systems
** 5. for exposition only

32. Ad hoc computing was a major problem of which of the phases of IRM evolution?

1. manual processing phase
2. computer technology phase
** 3. personal computing phase
4. IRM phase
5. All of the above

33. Which of the following is a benefit of I-CASE tool use in information engineering?

** 1. improved identification of information requirements
2. streamlined business processes
3. improved business focus
4. improved customer focus
5. All of the above

34. Which of the following agencies exerts general supervisory control over the budgetary activities of executive agencies?

1. General Services Administration
2. General Accounting Office
** 3. Office of Management and Budget
4. Defense Information Services Agency
5. Internal Revenue Service

35. Distinct activities that have inputs and outputs and may be implemented by people, machines, or computers are

** 1. business processes.
2. computer processes.
3. functions.
4. transactions.
5. data flows.

36. For which of the following phases of the systems development life-cycle are user-identified systems problems a primary trigger?

1. analysis
2. design
3. implementation
4. planning
** 5. support

37. What was the underlying cause of the evolution of IRM concepts?

1. management information systems
2. economies of scale
3. automation of business processes
** 4. technology push and demand pull
5. boundary spanning

38. In which phase of information engineering are organizational mission and structure defined?

** 1. planning
2. analysis
3. design
4. construction
5. engineering

39. Which of the following laws established an individual's right to review federal records containing personal information about him/her maintained by federal agencies?

** 1. Privacy Act of 1974
2. Freedom of Information Act of 1966
3. Federal Records Act of 1968
4. Computer Security Act of 1987
5. Brooks Act of 1965

40. Which of the following is NOT a business process improvement (BPI) method?

1. activity models
2. data models
3. functional economic analysis
** 4. information engineering
5. activity based costing

41. Which of the following has NOT evolved as a goal of IRM?

** 1. Prove the feasibility of organizational computing.
2. Maximize the benefit of information resources to the organization as a whole.
3. Strategic application of information resources
4. Shared information resources across functions
5. Functional management responsibility for systems requirements

42. Which of the following is NOT a characteristic of information engineering methodology?

1. enterprise-wide perspective
2. business focus
** 3. bottom-up identification of information requirements
4. automated systems development
5. integrated systems development

43. Which of the following defines the future direction of the organization?

** 1. vision statement
2. mission statement
3. goals
4. objectives
5. strategies

44. Which of the following is the graphical representation of information and data assets expressed in terms of entities and relationships?

** 1. data model
2. business model
3. activity model
4. information model
5. interaction model

45. Which of the following involves the ability to break a large business problem down into its component parts, analyze the various aspects of the problem, and then assemble a system to solve the problem?

1. general business knowledge
2. systems analysis and design skills
3. computer programming experience and expertise
** 4. problem-solving skills
5. interpersonal relations skills

46. Which of the following is NOT required of the organization in response to the shift to an information-based society?

** 1. large scale investment in information technology
2. continuous product and process innovation
3. constant internal organizational renewal
4. protection from information overload
5. organizational design for knowledge work and decision making

47. Which of the following is part of the environmental analysis stage of strategic planning process?

** 1. identification of internal strengths and weaknesses
2. definition of organizational mission
3. development of organizational strategies
4. creation of organizational vision statement
5. All of the above

48. Which of the following is NOT true of information engineering?

1. supports the entire systems development life-cycle
2. seeks to integrate systems across the value chain
3. is data-centered and data-driven
** 4. is designed to develop software for individual systems
5. seeks to streamline organizational procedures

49. Information engineering methodology stresses which of the following?

1. customer involvement
2. top-down partitioning of models
3. quick completion of systems
4. business focus
** 5. All of the above

50. Why must systems be controlled?

1. systems exhibit differentiation
2. systems have inputs and outputs
3. components of a system interact
** 4. systems exhibit entropy
5. systems are goal-seeking

51. Good data management is a tenet of IRM. Which of the following is NOT an element of good data management?

1. data elements mean the same thing to everyone in the organization
** 2. data elements are flexibly defined to meet situational requirements
3. someone must be responsible for the data
4. everyone who needs and has a right to data should be able to access it
5. None of the above (All are elements of good data management.)

52. Over half the workers in the U.S. today are

1. directly involved in the manufacture of products.
** 2. knowledge workers.
3. blue-collar workers.
4. clerical and secretarial workers.
5. factory workers.

53. For which of the following phases of the systems development life-cycle are business and information system plans a key output?

1. analysis
2. design
3. implementation
** 4. planning
5. support

54. Which of the following is NOT a trigger for a systems development project?

1. problems
** 2. feasibility assessments
3. opportunities
4. directives
5. All of the above

55. Which of the following is NOT an example of a mechanism?

1. machines
2. facilities
** 3. regulations
4. systems
5. personnel

56. Which of the following factors does NOT influence an organization's environmental turbulence (pace of change)?

1. technology
2. competition
3. end-user computing
** 4. costs
5. environmental complexity

57. Which of the following activities is best described as recording facts and specifications for a system?

1. fact-finding
** 2. documentation
3. estimation
4. measurement
5. process management

58. Which of the following is a goal of CIM?

** 1. tie DoD organizations together through common, shared data
2. place increased emphasis on information technology acquisition
3. implement a rigid world-wide information infrastructure
4. minimize duplication through increased automation
5. All of the above

59. Which of the following does NOT contribute to the need for strategic planning?

1. environmental instability
2. desire to integrate business functions
** 3. predictable future events
4. rapidly changing technology
5. desire to identify business opportunities

60. Why is IRM strategic planning important to an organization?

** 1. IRM directly supports the organizational mission
2. All functions must have a strategic plan
3. IRM strategic plan is the foundation for the organizational strategic plan
4. IRM strategic plan is the primary input for acquisitions planning
5. All of the above

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13. ABSTRACT *(Maximum 200 words)*

The federal government has passed laws and issued directives recognizing that information is a valuable national resource. To help assure that Air Force information managers are capable of implementing policy in support of such laws and directives, the Secretary of the Air Force's Directorate of Information Management (SAF/AAI) directed a team from the Air Force Institute of Technology (AFIT) to design and construct an exportable course to provide an overview of information resources management (IRM) concepts and principles. Such an IRM course was completed in the Summer of 1994. The authors evaluated this course quantitatively and qualitatively. During a pilot administration of the course, the authors used a quantitative measurement instrument and a pretest/posttest research design to assess effectiveness of the instructional system. The authors also gathered feedback from students and instructors to provide a summative evaluation of the course as a whole. Based on test scores and qualitative feedback, the authors concluded that the course did provide a useful overview of IRM concepts and principles. Additionally, they were able to recommend several changes to the course presentation, content, and measurement instrument.

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